"EFFECT OF GLENOHUMERAL MOBILIZATION AND EXERCISES COMBINED WITH SCAPULAR TAPING ON PAIN AND FUNCTION IN PATIENTS WITHSUB-ACROMIAL IMPINGEMENT SYNDROME"

-AN EXPERIMENTAL STUDY

A DISSERTATION SUBMITTED TO THE TAMILNADU

Dr. M.G.R MEDICALUNIVERSITY, CHENNAI,AS PARTIAL

FULFILLMENT OF THEMASTER OF PHYSIOTHERAPY DEGREE

APRIL 2012

A Dissertation on

"EFFECT OF GLENOHUMERAL MOBILIZATION AND EXERCISES COMBINED WITH SCAPULAR TAPING ON PAIN AND FUNCTION IN PATIENTS WITH SUB-ACROMIAL IMPINGEMENT SYNDROME"

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Has been submitted in partial fulfillment of the requirement of the

Master of Physiotherapy degree

APRIL 2012

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Internal Examiner		**External Examiner**

CERTIFICATE

Certified that this is the bonafide work of **Miss. S.R. JANANI** of K.G. College of Physiotherapy, Coimbatore submitted in partial fulfillment of the requirements for the Master of Physiotherapy Degree course from the Tamil Nadu Dr.M.G.R. Medical University under the **Registration No: 27102202**for the April 2012 Examination.

Place : Coimbatore **Principal**

Date :

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-AN EXPERIMENTAL STUDY

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I INTRODUCTION

Shoulder disorders are a common cause of persistent musculoskeletal morbidity, in the middle to older age group (Badley EM et al). Shoulder complaints are one of the common musculoskeletal complaints seen by healthcare professionals with the incidence per of 9.5 per1000 patients presenting to primary care and varying data for point prevalence 6.9% -26%(Lumime JJ et al).

Shoulder impingement syndrome is a chronic condition caused by repetitive overhead activities that damages glenoid labrum, long head of biceps brachii and acromial bursae. Impingement syndrome includes pathologies of rotator cuff disease such as sub-acromial bursitis, partial rotator cuff tear and bicipital tendinosis.

Sub-acromial impingement of shoulder occurs due to mechanical disturbances within the sub-acromial space and is characterized by pain and functional restrictions mostly during overhead activities in daily life or sporting activities(Lewis JS et al).

Potential factors causing sub acromial impingement syndrome are impaired strength, coordination and integrity of the rotator cuff and shoulder girdle muscles, mechanical or anatomical changes, hypo mobility or instability of the glenohumeral joint or the scapula and the influence of posture.

Sub-acromial impingement is characterized clinically by pain with abduction (painful arc) and signs of impingement. The sub-acromial bursae have been shown to contain free nerve endings, ruffini endings and pacinian corpuscles most of which are located on roof side of bursae facing acromion. It is believed that these nociceptors relay stimuli caused by impingement that are interpreted as pain.

Impingement can be categorized into three stages,

Stage 1: Edema and Inflammation

Stage 2: Fibrosis and Tendinitis

Stage 3: Bone spurs and Tendon Ruptures

The impingement can be classified based on etiology into, primary impingement and secondary impingement.

Primary impingement refers to mechanical encroachment into sub - acromial space by humeral head.

Secondary impingement can result from shoulder instability, scapulothoracic muscular weakness, posterior capsular tightness which can contribute to a subtle anterior instability.

The diagnosis of sub-acromial impingement syndrome is often based on a through history and clinical examination, technical examination methods such as magnetic resonance imaging or ultrasonography. These investigations are often not used in first instance because their diagnostic accuracy is still limited or to exclude other less common shoulder pathologies.

However presence of one of the following signs may indicate sub-acromial impingement syndrome; complaints of pain in the glenohumeral joint region or the proximal arm, Neer's impingement and Hawkin's – Kennedy impingement test positive, painful arc with active abduction or flexion , pain with one of the following resistance tests- external rotation , internal rotation, abduction or flexion.

Physiotherapy management is the first choice of treatment for sub-acromial impingement syndrome. The effectiveness of physiotherapy in patients with sub-acromial impingement syndrome is still under debate. The commonly used modalities in the management are scapular retraining, rotator cuff exercises, spinal and shoulder mobilization, soft tissue massage, taping, less emphasis is placed on electrotherapy modalities.

The aims of the resultant physiotherapy interventions are to decrease pain, improve range of shoulder motion, improve scapular control, strengthen

scapular stabilizers and rotator cuff muscles, improve posture and thoracic extension range of motion, regain normal shoulder biomechanics.

A combination of modalities of physiotherapy especially manual therapy and exercises with scapular taping as an adjunctive treatment is commonly used for shoulder impingement pathology.

Earlier studies substantiates that individuals with shoulder impingement syndrome often have tight posterior capsule and reduction in glenohumeral internal rotation range of motion. Administration of joint mobilizations with exercises results in superior outcome superior than with therapeutic exercises alone. Mobilization forces can be directed to a specific area of the capsule to restore capsular extensibility.

Thus, grade III or grade IV mobilizations were aimed at restoring posterior capsule mobility, thereby increasing active range of motion and decreasing the impingement symptoms, whereas all grades of mobilization [I- IV] may result in pain reduction.

Roy et al investigated the effects of strengthening exercises and reported that there was reduction in flexion and abduction painful arc. Kamkar et al indicated that rotator cuff muscles, especially strengthening of infraspinatus and teres minor muscles have critical role in the treatment of sub- acromial

impingement syndrome. Rotator cuff muscles stabilize the humeral head in the glenoid , preventing the superior and anterior translation of head and causing humerus to rotate in outward direction while protecting the distance between large tubercle and acromion in anatomical position and preventing compression.

Kinesiotaping method in conjunction with other therapeutic interventions may facilitate muscle function, support joint structure, reduce pain, provide proprioceptive feedback to achieve & maintain preferred body alignment (Jaraczwska Ewa). The scapular taping technique aims to encourage a retracted, depressed scapular posture and thoracic extension. Postural taping is given for scapular retraining in order to improve the control of scapular movement.

The reduction in pain as a result of scapular taping may allow more effective administration of manual techniques and exercises based targeting the shoulder dysfunction. An electromyographic study on symptomatic sub-acromial impingement subjects found scapula taping significantly reduced the activity of upper trapezius muscle.

1.1 NEED FOR THE STUDY

Based on previous literature, Scapula taping, glenohumeral mobilization with exercises is significant in reducing pain and improving function in sub-acromial impingement syndrome. This study aims to evaluate the effectiveness of combinations of physiotherapy techniques on pain and function in patients presenting with clinic signs of sub-acromial impingement syndrome.

1.2 PURPOSE OF THE STUDY

To compare the effectiveness of three physical therapy interventions in the treatment of sub-acromial impingement syndrome:

- GROUP A: Scapula taping, Glenohumeral mobilization, Exercises
- GROUP B: Glenohumeral mobilization and Exercises.
- GROUP C: Exercises alone

1.3 OBJECTIVES OF STUDY

- To study the effect of glenohumeral mobilization and exercises combined with scapular taping on pain and function in patients with sub-acromial impingement syndrome.

1.4 HYPOTHESIS

NULL HYPOTHESIS

- There is no significant effect of glenohumeral mobilization and exercises combined with scapular taping on pain and function in patients with sub-acromial impingement syndrome.

ALTERNATE HYPOTHESIS

- There is significant effect of glenohumeral mobilization and exercises combined with scapular taping on pain and function in patients with sub-acromial impingement syndrome.

II REVIEW OF LITERATURE

SUB-ACROMIAL IMPINGEMENT SYNDROME

Larsen et al., (2010)

Stated that sub-acromial impingement syndrome (SIS) is the most common shoulder disorder in the population, representing 44-65% of all registered shoulder complaints in the clinical setting.

Michener et al., (2003); Solem-Bertoft et al., (1993)

Stated that the trapezius and serratus anterior are paired to form the force couple which controls the movement of the scapular upward rotation and posterior tilt. These components of scapular movement are essential for widening the sub-acromial space to prevent the impingement of the sub –acromial tissues.

Lewis et al., (2001)

Described that sub-acromial impingement syndrome of the shoulder (SIS) occurs due to mechanical disturbance within the sub-acromial space and is characterized by pain and functional restrictions mostly during overhead activities in daily life or sporting activities.

Ludewig and Cook et al., (2000)

Stated that sub-acromial impingement can result from a variety of factors which may lead to or cause dysfunctional glenohumeral and scapulothoracic movement patterns.

Ludewig and Cook, (2000)

Stated that the abnormal motions such as decrease in scapular upward rotation about an axis approximately perpendicular to the scapular plane, decrease in posterior tipping about an axis approximately parallel to the scapular that bring the head of humerus and rotator cuff tendons closer with the coraco-acromial arch during arm elevation are encountered in impingement syndromes.

Lukasiewicz et al., (1999)

Stated that subjects had to demonstrated least three of the following to be classified as having impingement: a positive Neer ‘s impingement and Hawkins impingement test, pain with active shoulder elevation, palpation of the rotator cuff tendons, pain with isometric resisted abduction, and pain in the C5 or C6 dermatome region.

Deutsch et al., (1996)

Described the potential factors causing or contributing to sub-acromial impingement syndrome such which includes strength, coordination and integrity of

the rotator cuff and the shoulder girdle muscles , mechanical or anatomical changes, hypo mobility or in stability of the glenohumeral joint or the scapula and this suggest a multi-factorial etiology of sub-acromial impingement syndrome.

Glousman et al., (1993)

Described the etiology of secondary impingement which includes subtle glenohumeral instability or hyper mobility. It has been proposed that such instability combined with inadequate recruitment of the active stabilizers of the glenohumeral or scapulothoracic joint, results in excessive anterior and superior migration of the humeral head. Excessive displacement of the humeral head in turn encroaches on the soft tissues lying within the sub-acromial space.

Warner et al., (1990)

Stated that cumulative micro trauma sustained by the sub-acromial tissues during overuse and repetitive sub-acromial loading is the theorized cause of primary impingement. Intrinsic degenerative tendinopathies of the rotator cuff and anatomic variations of the acromion process are thought to increase the vulnerability of this region to impingement. Posterior capsule tightness and weakness of the shoulder rotator musculature have also been reported in patients with primary shoulder impingement.

Neer, (1972)

Referred “shoulder impingement” to the compression of the rotator cuff, sub-acromial bursa and biceps tendon against the anterior under surface of the acromion and coraco-acromial ligament.

SCAPULAR TAPING

Peter Miller and Peter Osmotherly, (2009)

Concluded that taping provides reduction of pain when assessed by both self-reported measures of function and on active movements. Thus, the reduction in pain as a product of scapular taping may permit the more effective delivery of manual techniques and exercise-based interventions targeting the shoulder dysfunction. This benefit occurs only while the taping is continued and is not maintained on follow-up.

Peter miller et al., (2009)

Stated that scapular taping is commonly used as an adjunctive in the treatment of shoulder impingement.

Yin-Hsin Hsu et al., (2008)

The increase in the activity of lower trapezius muscle in the 60^0–30^0 lowering phase after taping was implied that the patients with shoulder

impingement might respond to the taping treatment. The trend of decreased lower trapezius activity between 90^0 and 120^0 of shoulder scaption was unexpected. A possible explanation was that the kinesiotaping had some supporting effects which helped the lower trapezius muscle to act more efficiently.

Yin-Hsin Hsu et al., (2008)

Stated that there was marginal increase of the lower trapezius muscle strength immediately, which can be explained by the results of the facilitated muscle activity and the improved scapular alignment. This indicates benefits of taping to aid the scapular muscle training in the patients with shoulder impingement syndrome.

Lewis et al., (2005)

Stated that taping can be used as a method of changing the thoracic kyphosis and scapular position.

Alexander et al., (2003); Ackermann et al., (2002)

Stated that taping works by offering constant proprioceptive feedback or providing alignment correction during dynamic movements.

Cools et al., (2003) and Ludewig and Cook, (2000)

Observed that there was inhibition of the serratus anterior and lower trapezius and over activation of the upper trapezius muscle in the patients with shoulder impingement syndrome.

Kaya et al.,(2003)

Stated that kinesiotaping may be an alternative treatment option especially when an immediate effect is needed in the management of shoulder impingement syndrome.

Endo et al., (2001)

Kinesio taping over the lower trapezius tended to increase scapular posterior tilt when humeral elevation was less than 90^0 in the subjects with shoulder impingement. It was observed that the decreased scapular posterior tilt in the subjects with shoulder impingement syndrome occurred around 45^0 and 90^0 of humeral elevation. This suggested that kinesiotaping might assist in correcting the affected scapular movements, and thus help these subjects to have their arm function on a more balanced and stabilized base (the scapula).

Hall, (1999); Herrington and Payton, (1997)

Stated that with repeated applications of scapula taping, the habituation to the tape may reduce the negative feedback of patients or even allow adaptation of neural pathways by consistent correct proprioceptive feedback.

Hall, (1999)

Suggested that scapula taping up to two or three weeks may be necessary to improve neuromuscular control and eight to twelve weeks of taping may be necessary to affect muscle length-tension properties.

GLENOHUMERAL MOBILIZATION

Michael Bang, Gail Deyle (2000)

Stated that the application of mobilization techniques optimized conditions for performing the strengthening exercise by reducing pain.

Michael Bang et al., (2000)

Stated that manual physical therapy might reduce pain by stimulating joint mechanoreceptor activity, which, in turn, is thought to block aberrant afferent pain signals and reduce the awareness of pain.

Douglas Conroy et al., (1998)

Described that mobilization may have an important role in restoring capsular extensibility in primary shoulder impingement syndrome by preventing or

stretching abnormal collagen cross-linkage, rupturing adhesions, reducing oedema, or reducing pain.

Maitland, (1991)

Stated that in most cases, passive accessory or passive physiological joint mobilization maitland grades I-V were used.

Harryman, (1990); Grossman, (2005)

Found that individuals with impingement often have a tight posterior capsule which leads to altered glenohumeral arthrokinematics and a decrease in internal rotation of glenohumeral joint. Therefore grade III or IV mobilizations are performed to restore the posterior capsule mobility. Restoration of posterior capsule mobility result in increased active range of motion, decreased impingement symptoms. Whereas all grades of mobilizations (I-IV) may result in pain reduction.

Melzak, (1965); Wall, (1978); Threlkeld, (1992)

Stated that manual techniques such as mobilization and mulligan mobilization with movement activate the mechanoreceptors and inhibit the nociceptive stimuli through gate control mechanism to reduce pain. It also helps to facilitate synovial fluid nutrition, stretch capsule and restore normal glenohumeral arthrokinematics.

EXERCISES

Thilo kromer et al., (2010)

Stated that exercises were aimed at restoration of muscular deficits in strength, mobility and co-ordination of rotator cuff and shoulder girdle, unloading sub-acromial space and centring humeral head during the movements in glenoid fossa.

Joseph Myers et al., (2006)

Emphasized that supervised exercise programme aimed at relearning of normal patterns of movement in arm elevation, reduction of mechanical sub-acromial stress, specific endurance training to increase nutrition of the collagen tissue and simple advice to prevent recurrence would be the first treatment alternative for patients with sub-acromial impingement syndrome.

Markus Walther et al., (2004)

Stated that physiotherapy aimed at strengthening the depressor muscles and centring the humeral head therefore, reduce sub-acromial impingement. Because the position of the scapula also has a high impact on the width of the sub-acromial space, the training programs involving the pectoralis minor, trapezius, rhomboids, levator scapulae, and serratus anterior were effective.

Philip McClure et al., (2004)

Stated that strengthening the rotator cuff, increasing the flexibility of the posterior glenohumeral capsule, and encouraging upper thoracic extension and a retracted head position may result in improved muscle force, motion, pain, and function in a group of patients with shoulder impingement.

Bang and Deyle, (2000)

Stated that the stretching of pectoralis minor muscle is indicated, as its tightness would limit normal posterior tipping and scapular upward rotation through its insertion on the coracoid process. Posterior capsule stretching promote normal humeral head posterior translation and prevent excess anterior humeral head translation during elevation.

Ludewig PM and Cook TM, (2000); Kamkar A, Irrgang JJ and Whitney SL, (1993)

Stated that serratus anterior is targeted in exercise programmes, due to its primary role in controlling scapular upward rotation and posterior tipping, as well as due to reductions in serratus muscle activity in impingement subjects. However, excessive upper trapezius activity results in abnormal superior translation and reduced rotation of the scapula. Thus, exercise programmes should reduce upper trapezius activity during humeral elevation.

Kamkar A, Irrgang JJ and Whitney SL (1993);Ludewig PM, Cook TM, (2002)

Stated that increase in humeral anterior and superior translations during the arm elevation compromises the available sub-acromial space. Rotator cuff exercises, particularly to the infraspinatus and teres minor are included in impingement treatment programmes. These rotator cuff muscles stabilize the head of humerus on the glenoid and prevent excessive superior and anterior humeral head translations, and bring about humeral external rotation to clear the greater tuberosity from beneath the acromion.

Brox et al., (1993, 1999)

Reported significant improvements in subjects with sub-acromial impingement at both 6 month and 2.5 years in those who were in exercise group compared to placebo.

Pink M et al., (1991)

Described that exercises were designed to restore synchronous scapulohumeral rhythm, either through stretching to restore glenohumeral capsular mobility or strengthening to restore strength and timing of the rotator cuff and para scapular musculature.

MANUAL THERAPY AND EXERCISES

Gamze senbursa et al., (2011)

Stated that supervised exercises, manual therapy and home-based exercises are effective and promising methods in the rehabilitation of patients with sub-acromial impingement syndrome.

Aimie F.kachingwe et al., (2008)

Conducted a study to compare four physical therapy interventions in the treatment of primary shoulder impingement syndrome. Pain intensity and function was measured using visual analog scale and shoulder pain and disability index. Mobilization and movement with mobilization groups with supervised exercise showed a greater change on all pain intensity measures than control group and exercise only group. On shoulder pain and disability index all the intervention groups had a greater percentage of change than control group. They stated that glenohumeral mobilizations and mulligan mobilization with movement along with a supervised exercise program resulted in greater decrease in pain and improved function when compared to the supervised exercise alone.

Desmeules et al., (2003)

Stated that therapeutic exercise or manual therapy is beneficial in comparison with other treatments such as acromioplasty, placebo, or no intervention.

Michael Bang and Gail Deyle, (2000)

Described that manual physical therapy when combined with supervised shoulder exercise is superior to supervised shoulder exercise alone for enhancing strength and function and reducing pain in patients with shoulder impingement syndrome.

Conroy et al., (1998); Bang et al., (2000)

Suggested that including joint mobilizations in the management of shoulder impingement results in superior outcomes compared with therapeutic exercise alone.

Tuite et al., (1995); Nicholson et al.,(1996)

Combination of manual therapy and exercises is commonly used in the management of sub-acromial impingement syndrome. It aims to correct the modifiable physical impairments causing pain and dysfunction. Such impairments are tightness of the posterior capsule, postural abnormalities, rotator cuff and scapular muscle weakness and dysfunction and other soft tissues.

EXERCISES AND TAPING

McClure et al., (2004)

Stated that the effective interventions for sub-acromial impingement syndrome include strengthening exercises to the rotator cuff and scapular

stabilizing musculatures, stretching to decrease capsular tightness, scapular taping techniques and patient education of proper posture.

Green, Buchbinder et al., (2002)

Stated that management of shoulder impingement pathology should address the primary underlying causative factors. This includes treatment for posture and neuromuscular control via specific exercise and facilitatory taping.

OUT COME MEASURES

Williams et al., (1995)

Stated that the shoulder pain and disability index, a 13-item self-administered questionnaire measuring, shoulder functional status have good test-retest reliability, responsiveness and validity.

Carlssons, (1983)

The visual analogue scale (VAS) is a simple and frequently used method for the assessment of variations in intensity of pain. In clinical practice the percentage of pain relief, assessed by visual analogue scale is often considered as a measure of the efficacy of treatment.

III METHODOLOGY

3.1STUDY DESIGN

Pre-test and Post- test Experimental group study design.

3.2STUDY SETTING

Study will be conducted at Department of Physiotherapy, KG Hospital and K.G Pain relief centre, K.G. College of Physiotherapy, Coimbatore.

3.3 STUDY DURATION

Total study duration is one year. Treatment duration for each patient is six weeks.

3.4 SAMPLING

30 patients who fulfilled the predetermined inclusive and exclusive criteria were selected and divided into three groups by convenience sampling method. Each group consists of 10 patients. Groups are named as Group A, Group B and Group C.

3.5 SELECTION CRITERIA

INCLUSION CRITERIA:

- Age between 35-50 years.
- Symptoms for more than 4 weeks.
- Main complaint in glenohumeral joint region or proximal humerus.
- Presence of one of the following signs indicating sub-acromial impingement syndrome: Neer's impingement, Hawkins -Kennedy impingement, painful arc with active abduction.
- Pain with one of the following resistance tests: External rotation, internal rotation ,abduction.

EXCLUSIVE CRITERIA:

- Resting shoulder pain 8/10 on VAS scale.
- Primary scapulo-thoracic dysfunction due to paresis.
- Diagnosed glenohumeral instability or previous history of dislocation.
- Adhesive capsulitis.
- More than 50% restriction of passive range of motion in two or more planes.

- Shoulder surgery in last 12 months on involved side.
- Reproduction of symptoms with active or passive cervical movements
- Neurological involvement with sensory and muscular deficit.
- Inflammatory joint disease.
- Symptoms of complex regional pain syndrome.

3.6 VARIABLES

INDEPENDENT VARIABLES:

- Glenohumeral mobilization
- Scapular taping
- Exercises

DEPENDENT VARIABLES:

- Pain
- Function

3.7 OUTCOME MEASURES AND PARAMETERS:

- **OUTCOME MEASURES:**
  - Visual Analogue Scale (VAS)
  - Shoulder Pain And Disability Index (SPADI)
- **PARAMETERS**
  - Pain
  - Function

3.8 PROCEDURE

30 patients were divided into 3 groups, each group consisted of 10 patients. Group A were given glenohumeral mobilization, scapular taping, exercises, Group B were given glenohumeral mobilization and exercises, Group C were exercises only.

SCAPULAR TAPING

- Scapular taping was applied 3 times per week for first two weeks of their treatment. Each taping was removed after 2 days in situ.
- The method of scapular taping was based on common dysfunctions of winging, pseudo winging, and excess downward rotation.
- The taping consisted of 2 straps :
    - One strap anchored over the anterior deltoid muscle and extended posteriorly along the line of spine of scapula terminating in mid-line.
    - Second strap anchored anteriorly over the coracoid process and extended posteriorly and infero-medially over the scapula in imitation of the line of pull of lower trapezius.
- Skin preparation included the use of a protective barrier wipe beneath the adhesive tape to assist in maintaining skin integrity.

- An initial tape layer comprised a 50mm hypoallergenic poly-acrylate adhesive non-woven bandage over which are laid a 38 mm premium non-elastic zinc oxide adhesive tapes.

GLENOHUMERAL MOBILIZATION

- The anterior, posterior, inferior glenohumeral glides along with long axis distractions were given.
- Using 0 – 6 accessory motion scale, passive accessory motions were evaluated and graded.
- The amount of pain and joint reactivity during passive accessory motion testing was graded on 0 – 3 point scale
    - 0- no reactivity
    - 1- minimal
    - 2 - moderate
    - 3 - severe reactivity
- In order to determine the intensity and direction of the mobilization the reactivity and grade of joint mobility were used.
- Glenohumeral anterior, posterior, inferior glides along with long axis distractions, grade I - IV joint mobilizations were given.

- Where there was reactivity grade I – II mobilization were applied.
- Where there was no reactivity but capsular hypo mobility grades III – IV accessory motions were applied.
- Each mobilization was applied for 30 seconds at a rate of one mobilization every 1 or 2 seconds followed by 30 seconds rest.
- The 30 seconds mobilization and the resting session were repeated two additional times, thus a total of 3 sets of 30 seconds mobilizations were given.
- Exercises are given after mobilizations.
- At the end of each session subjects received cold pack for 10 – 15 minutes to reduce potential inflammation and delayed muscle soreness.

EXERCISES

- Scapular setting (5 seconds hold x 5 repetitions) in sitting.
- Resisted scapular setting- elbow extension with shoulder neutral (10 repetitions x 2 using theraband) in standing.
- Resisted scapular setting – elbow flexion (10 repetitions x 2 using theraband) in standing.

- Posterior shoulder stretch (5 repetitions with 10 seconds hold x 2) in standing.
- Pectoralis minor stretch (5 repetitions with 10 seconds hold x 2) in supine lying.
- Corner stretch (5 repetitions with 10 seconds hold x 2) in standing.
- Resisted internal rotation (10 repetitions x 2 using theraband) in standing.
- Resisted external rotation (10 repetitions x 2 using theraband) in standing.
- Self-resisted isometric external rotation (5 seconds hold x 10 repetitions) in standing.
- Active external rotation (10 repetitions x 2) in sitting.
- Resisted external rotation in supported 90˚ abduction (10 repetitions x 2 using hand weights) in sitting.
- Resisted internal rotation in supported 90˚ abduction (10 repetitions x 2 using theraband) in sitting.
- Resisted external rotation in unsupported abduction (10 repetitions x 2 using theraband) in standing.
- Resisted internal rotation in unsupported abduction (10 repetitions x 2 using theraband) in standing were given in subsequent weeks.

3.9 STATISTICAL TOOLS

- **Analysis of variance(ANOVA):**

Analysis of variance is a statistical technique specially designed to test whether the means of more than two quantitative populations are equal. The basic principle of ANOVA is to test for differences among the means of the populations by examining the amount of variations within each of these samples, relative to the amount of variation between the samples.

Formula:

$$F = \frac{S_1^2}{S_2^2}$$

Where, S_1^2 is $S_1^2 = \frac{\Sigma(X_1 - \bar{X}_1)2}{n_1 - 1}$

S_2^2 is $S_2^2 = \frac{\Sigma(X_2 - \bar{X}_2)2}{n_2 - 1}$

Formula: Paired t-test

$$S = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n-1}}$$

$$t = \frac{\bar{d}\sqrt{n}}{s}$$

Where,

d = difference between the pre- test versus post- test

$\bar{d}$ = mean difference

n = total number of subjects

S = standard deviation

Formula: Unpaired t-test

$$S = \sqrt{\frac{\sum\left(X_1 - \overline{X_2}\right)^2 + \sum\left(X_2 - \overline{X_2}\right)^2}{n_1 + n_2 - 2}}$$

$$t = \frac{\overline{X_1} - \overline{X_2}}{S}\sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

Where,

$\overline{x_1}$ = Mean of Group A

$\overline{x_2}$ = Mean of Group B

$\sum$ = sum of the value

n_1 = number of subjects in Group A

n_1 = number of subjects in Group B

S = standard deviation

Level of significance: 5%

IV DATA ANALYSIS AND INTERPRETATION

TABLE-I

ONE WAY ANOVA FOR PRE- TEST VALUES OF VAS SCORES BETWEEN AND WITHIN ALL GROUPS.

Source of variation	Sum of squares	Degrees of freedom	Mean squares	F ratio
Between groups	0.1167	2	5.833	0.1636
Errors	9.625	27	0.3565	
Total	9.742	29		

The observed F ratio for analyzing the variance between the groups in the critical region (critical value) is 3.35. This is greater than calculated value of 0.1636. So there is no significant difference in reduction of pain between the groups before the application of treatment interventions.

TABLE-II

ONE WAY ANOVA FOR POST TEST VALUES OF VAS SCORES BETWEEN AND WITHIN ALL THE GROUPS

Source of variation	Sum of squares	D.F	Mean squares	F ratio
Between groups	48.05	2	24.03	37.01
Errors	17.53	27	0.6491	
Total	65.58	29		

The observed F ratio for analyzing the variance between the groups in the critical region (critical value) is 3.35. This is lesser than calculated value of 37.01. So there is a significant difference in reduction of pain between the groups after the application of treatment intervention.

TABLE-III

ONE WAY ANOVA FOR PRE TEST VALUES OF SHOULDER PAIN & DISABILITY SCORES BETWEEN AND WITHIN ALL THE GROUPS

Source of variation	Sum of squares	D.F	Mean squares	F ratio
Between groups	19.40	2	9.700	0.1169
Errors	2241	27	82.99	
Total	2260	29		

The observed F ratio for analyzing the variance between the groups in the critical region (critical value) is 3.35. This is greater than calculated value of 0.1169. So there is no significant difference in reduction of shoulder pain and disability scores between the groups before the application of treatment intervention.

TABLE-IV

ONE WAY ANOVA FOR POST TEST VALUES OF SHOULDER PAIN AND DISABILITY SCORES BETWEEN AND WITHIN ALL THE GROUPS

Source of variation	Sum of squares	D.F	Mean squares	F ratio
Between groups	2893	2	1446	23.27
Errors	1678	27	62.15	
Total	4571	29		

The observed F ratio for analyzing the variance between the groups in the critical region (critical value) is 3.35. This is lesser than calculated value of 23.27. So that null hypothesis is rejected which indicates that there is a significant difference in reduction of shoulder pain and disability scores between the groups after the application of treatment intervention.

TABLE-V

UNPAIRED‘t’ TEST

MEAN, STANDARD DEVIATION, t-VALUE OF POST-TEST VALUES OF VAS SCORES BETWEEN GROUP A AND GROUP B

Groups	N	Mean	S.D	‘t’ value
GROUP A	10	1.8	0.854	4.06
GROUP B	10	3.35		

For 18 degrees of freedom and at 5% of level of significance tabulated value is 2.101. This is lesser than the calculated value of 4.06. So there is significant difference between post test values of Group A and Group B in reduction of pain.

GRAPH-I

COMPARING THE POST- TEST VAS SCORES BETWEEN GROUP A AND GROUP B

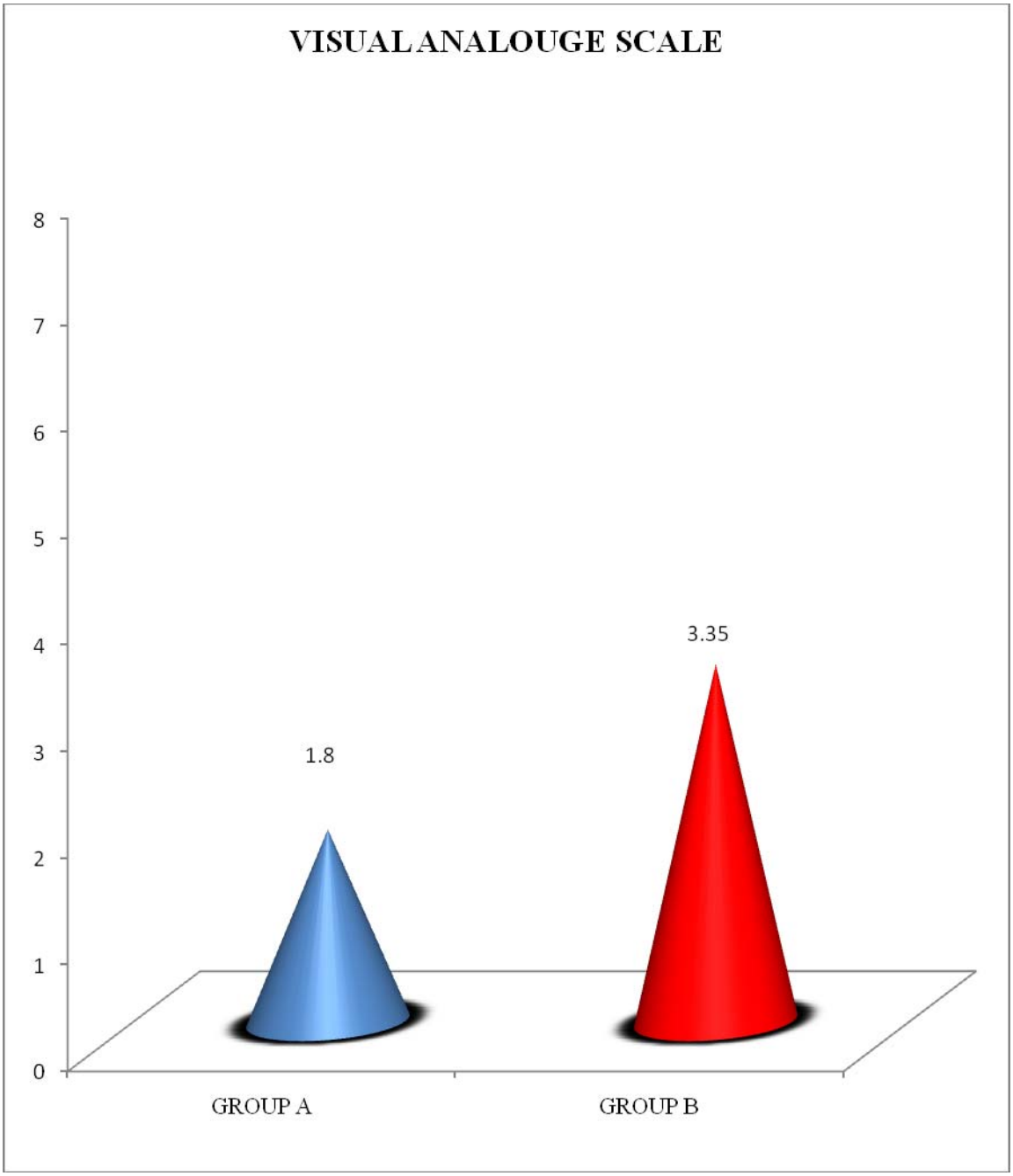


TABLE-VI

UNPAIRED‘t’ TEST

MEAN, STANDARD DEVIATION, t-VALUE OF POST-TEST VALUES OF VAS SCORES BETWEEN GROUP B AND GROUP C

Groups	N	Mean	S.D	‘t’ value
GROUP B	10	3.35	0.831	4.17
GROUP C	10	4.9		

For 18 degrees of freedom and at 5% of level of significance tabulated value is 2.101. This is lesser than the calculated value of 4.17. So the test showed that there is significant difference between post test values of Group B and Group C in reduction of pain.

GRAPH-II

COMPARING THE POST- TEST VAS SCORES BETWEEN GROUP B AND GROUP C

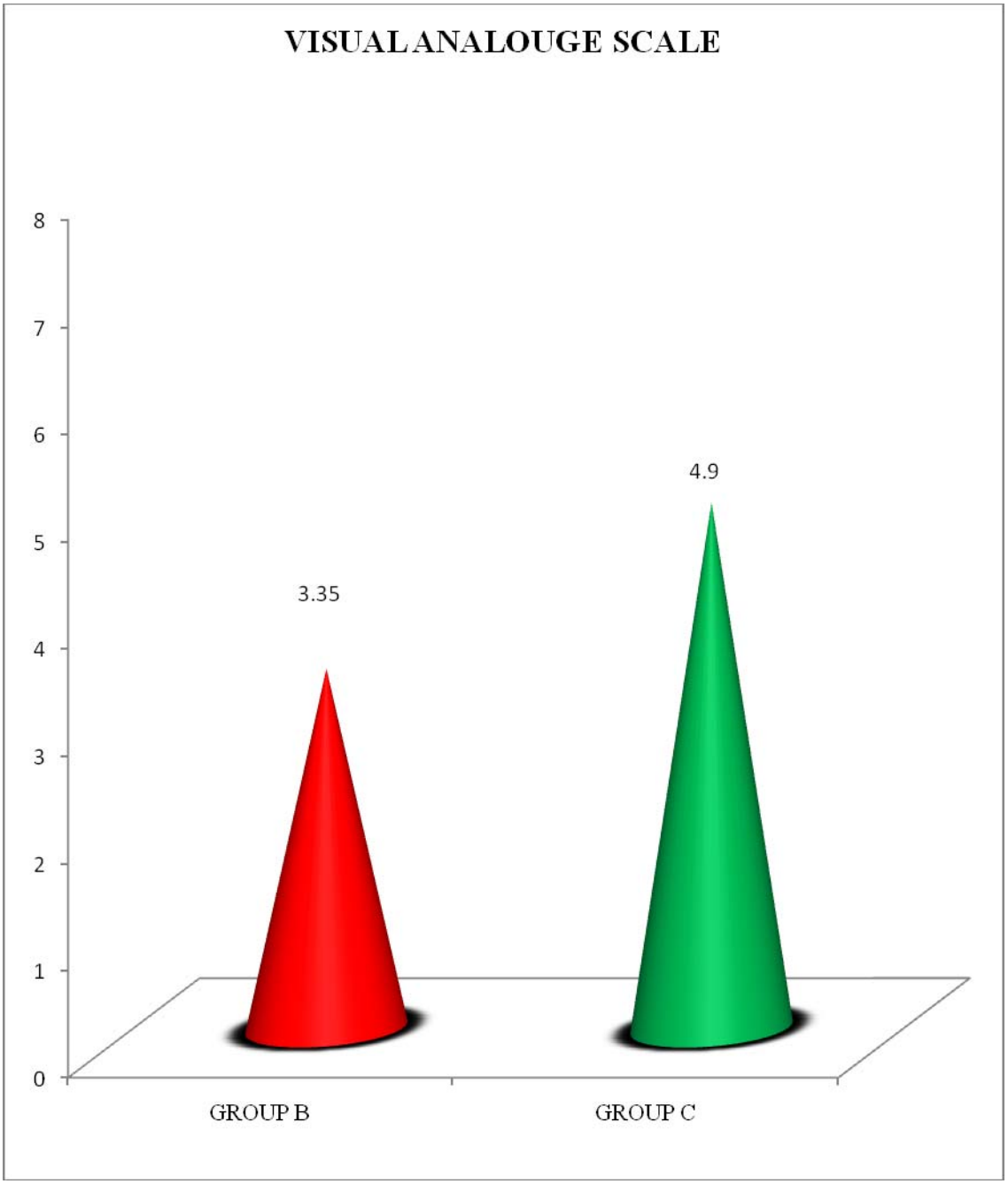


TABLE-VII

UNPAIRED‘t’ TEST

MEAN, STANDARD DEVIATION, t-VALUE OF POST-TEST VALUES OF VAS SCORES BETWEEN GROUP A AND GROUP C

Groups	N	Mean	S.D	‘t’ value
A	10	1.8	0.726	9.54
C	10	4.9		

For 18 degrees of freedom and at 5% of level of significance tabulated value is 2.101. This is lesser than the calculated value of 9.54. So there is significant difference between post- test values of Group B and Group C in reduction of pain.

GRAPH-III

COMPARING THE POST- TEST VAS SCORES BETWEEN GROUP A AND GROUP C

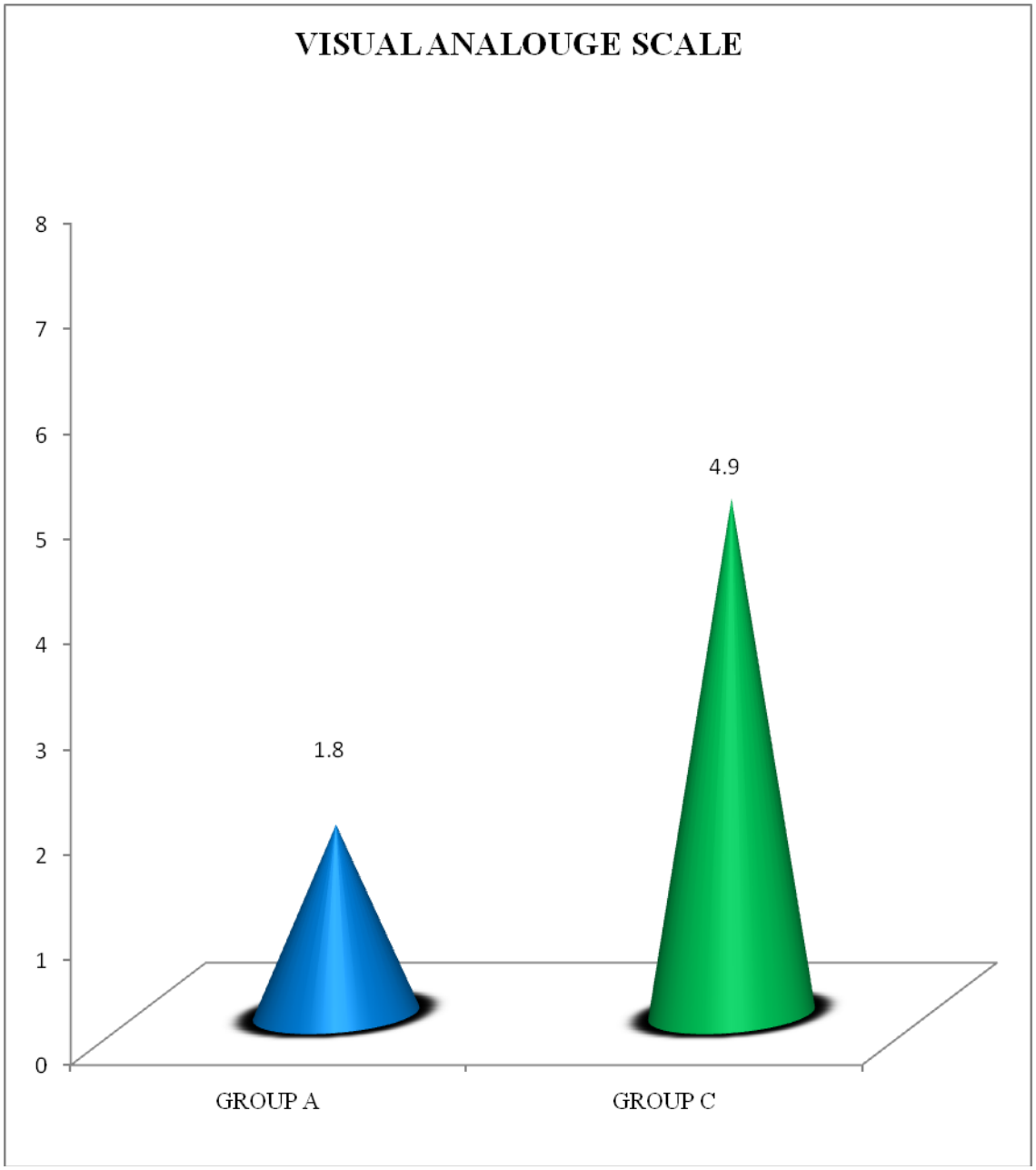


TABLE-VIII

UNPAIRED‘t’ TEST

MEAN, STANDARD DEVIATION, t-VALUES OF POST-TEST VALUES OF SHOULDER PAIN AND DISABILITY SCORES BETWEEN GROUP A AND GROUP B

Groups	N	Mean	S.D	‘t’ value
GROUP A	10	29.3	8.73	3.66
GROUP B	10	43.6		

For 18 degrees of freedom and at 5% of level of significance tabulated value is 2.101. This is lesser than the calculated value of 3.66. So there is significant difference between pos-t test values of Group A and Group B in reduction of shoulder pain and disability scores.

GRAPH-IV

COMPARING THE POST- TEST SHOULDER PAIN AND DISABILITY SCORES (SPADI) BETWEEN GROUP A AND GROUP B

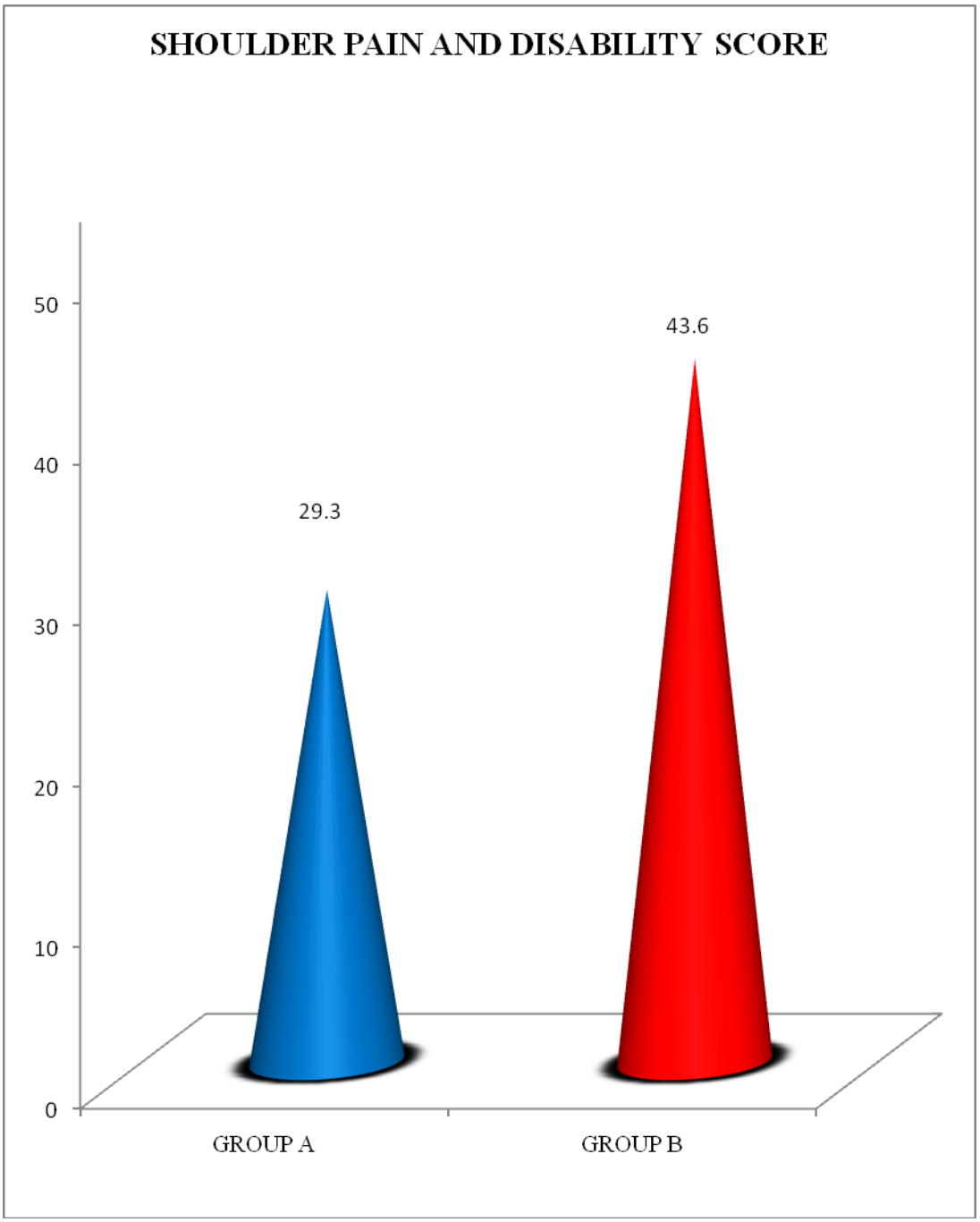


TABLE-IX

UNPAIRED‘t’ TEST

MEAN, STANDARD DEVIATION, t-VALUES OF POST-TEST VALUES OF SHOULDER PAIN AND DISABILITY SCORES BETWEEN GROUP B AND GROUP C

Groups	N	Mean	S.D	‘t’ value
GROUP B	10	43.6	8.73	2.46
GROUP C	10	53.2		

For 18 degrees of freedom and at 5% of level of significance tabulated value is 2.101. This is lesser than the calculated value of 2.46. So there is significant difference between post test values of Group B and Group C in reduction of shoulder pain and disability scores.

GRAPH-V

COMPARING THE POST- TEST SHOULDER PAIN AND DISABILITY SCORES BETWEEN GROUP B AND GROUP C

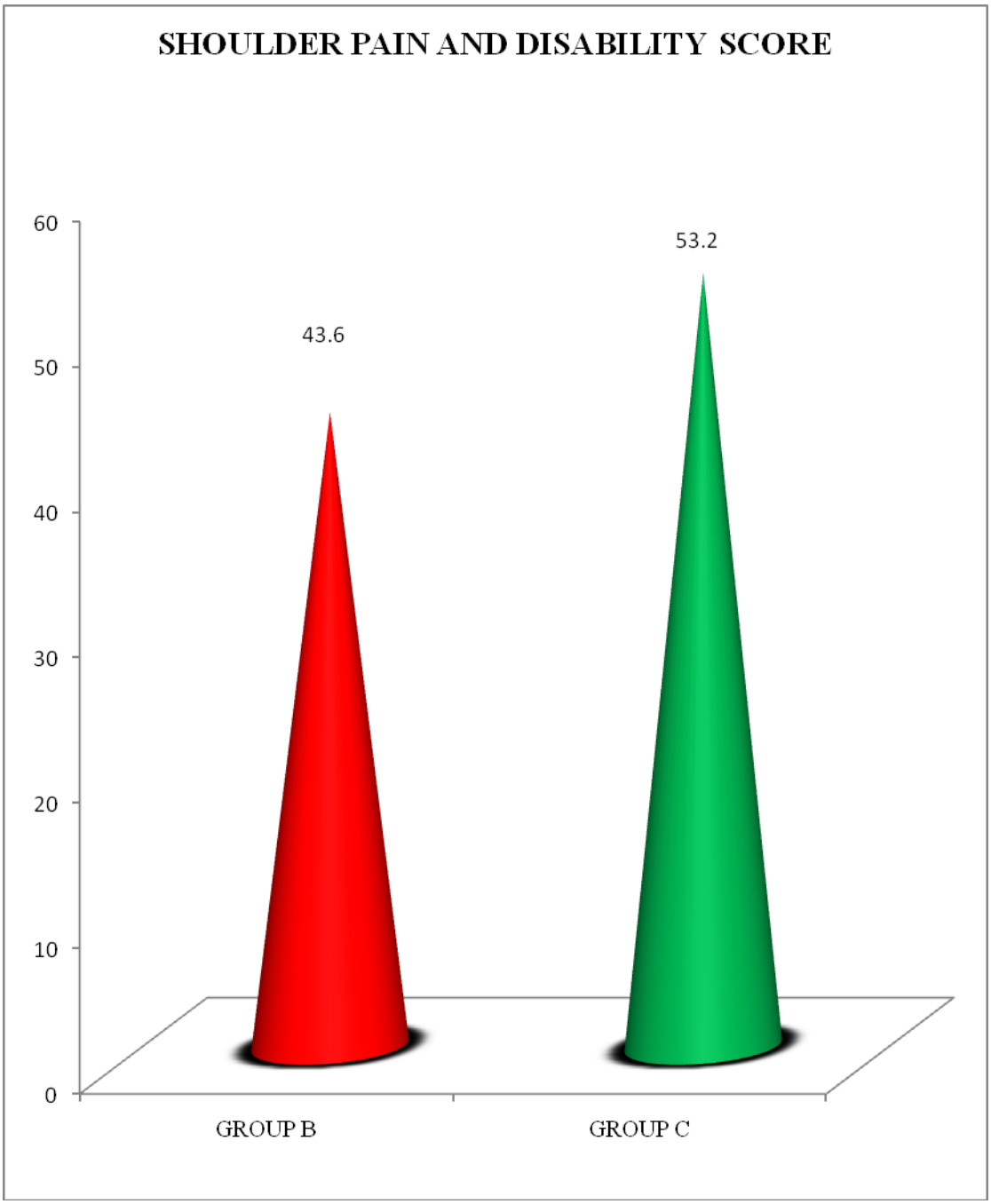


TABLE-X

UNPAIRED‘t’ TEST

MEAN, STANDARD DEVIATION, t-VALUE OF POST-TEST VALUES OF SHOULDER PAIN AND DISABILITY SCORES BETWEEN GROUP A AND GROUP C

Groups	N	Mean	S.D	‘t’ value
A	10	29.3	5.84	9.15
C	10	53.2		

For 18 degrees of freedom and at 5% of level of significance tabulated value is 2.101. This is lesser than the calculated value of 9.15. So there is significant difference between post -test values of Group A and Group C in reduction of shoulder pain and disability scores.

GRAPH-VI

COMPARING THE POST- TEST SHOULDER PAIN AND DISABILITY SCORES BETWEEN GROUP A AND GROUP C

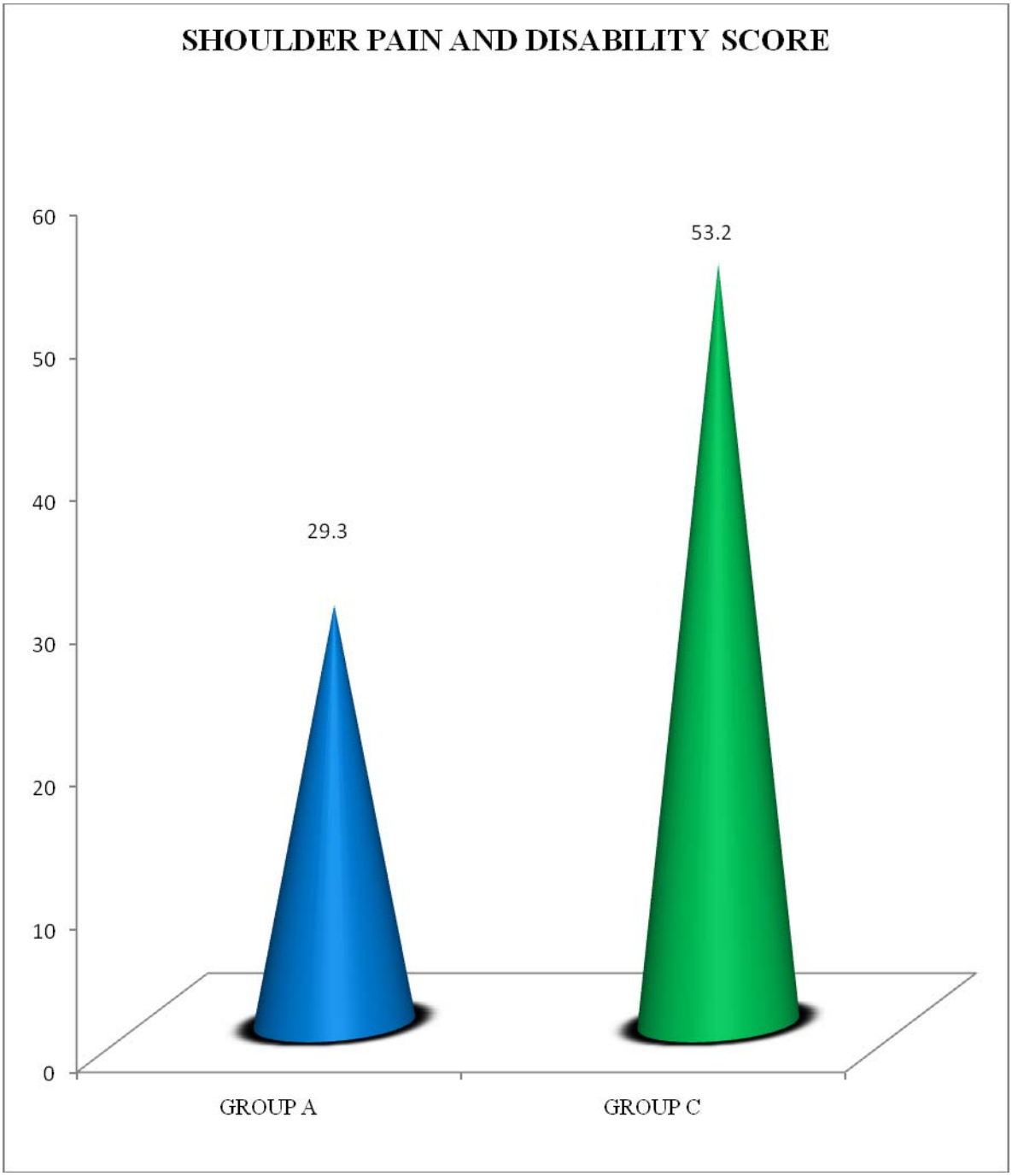


TABLE-XI

PAIRED‘t’ TEST

MEAN, STANDARD DEVIATION, t-VALUE OF PRE- TEST AND POST-TEST VALUES OF VAS SCORES IN GROUP A

S No	Pain	Mean	S.D	Mean difference	‘t’ value
1	Pre test	6.7	0.537	4.9	25.2
2	Post test	1.8	0.753		

For 9 degrees of freedom at 5 % level of significance, the table value is 2.262.This is lesser than the calculated value is 25.2. So there is significant effect of scapular taping, glenohumeral mobilizations and exercises (Group A) in reducing pain.

GRAPH-VII

COMPARING THE PRE- TEST AND POST- TEST VALUES OF VAS SCORE IN GROUP A [SCAPULAR TAPING, GLENOHUMERAL MOBILIZATION AND EXERCISES]

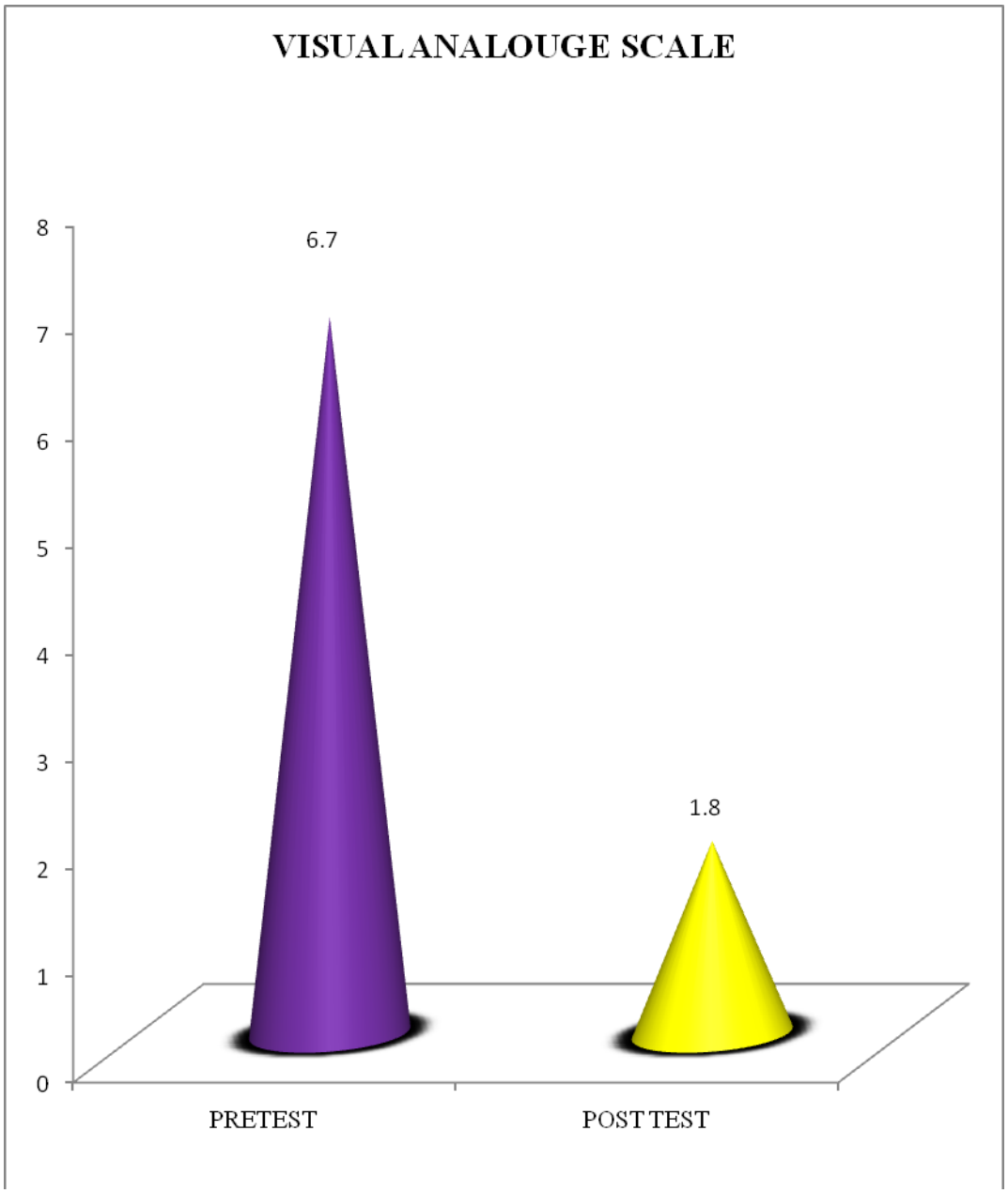


TABLE-XII

PAIRED ‘t’ TEST

MEAN, STANDARD DEVIATION, t-VALUE OF PRE- TEST AND POST-TEST VALUES OF VAS SCORES IN GROUP B

S No	Pain	Mean	S.D	Mean difference	‘t’ value
1	Pre test	6.75	0.486	3.40	8.22
2	Post test	3.35	0.944		

For 9 degrees of freedom and at 5 % level of significance, the table value is 2.262 This is lesser than the calculated value is 8.22. So there is significant effect of glenohumeral mobilizations and exercises (Group B) in reducing pain.

GRAPH-VIII

COMPARING THE PRE- TEST AND POST- TEST VALUES OF VAS SCORE IN GROUP B [GLENOHUMERAL MOBILIZATION AND EXERCISES]

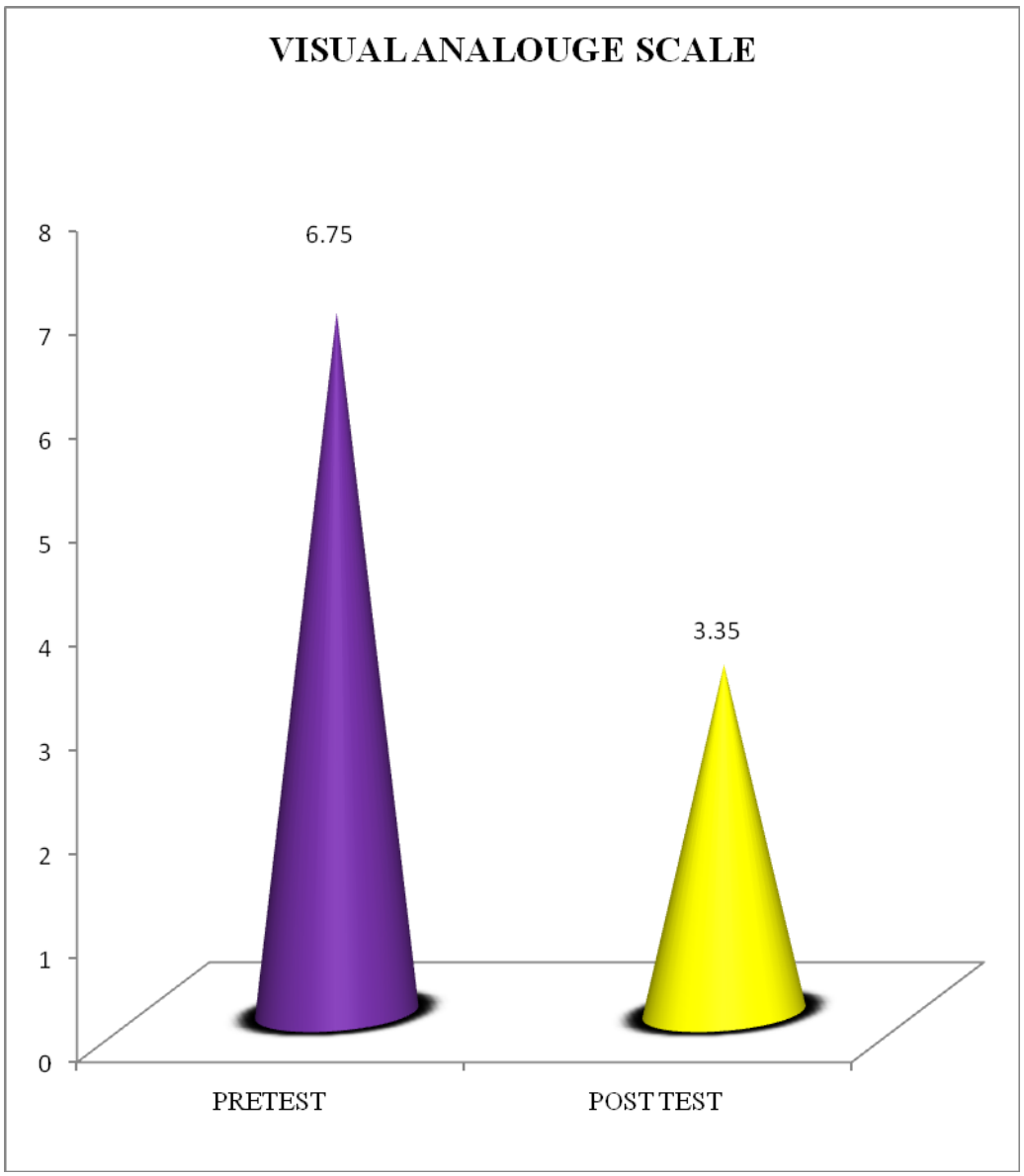


TABLE-XIII

PAIRED‘t’ TEST

MEAN, STANDARD DEVIATION, t-VALUE OF PRE- TEST AND POST-TEST VALUES OF VAS SCORES IN GROUP C

S NO	Pain	Mean	S.D	Mean difference	‘t’ value
1	Pre test	6.6	0.738	1.7	6.28
2	Post test	4.9	0.699		

For 9 degrees of freedom and at 5 % level of significance, the table value is 2.262 This is lesser than the calculated value is 6.28. So there was significant effect of exercises alone (Group C) in reducing pain.

GRAPH-IX

COMPARING THE PRE -TEST AND POST- TEST VALUES OF VAS SCORE IN GROUP C [EXERCISES ONLY]

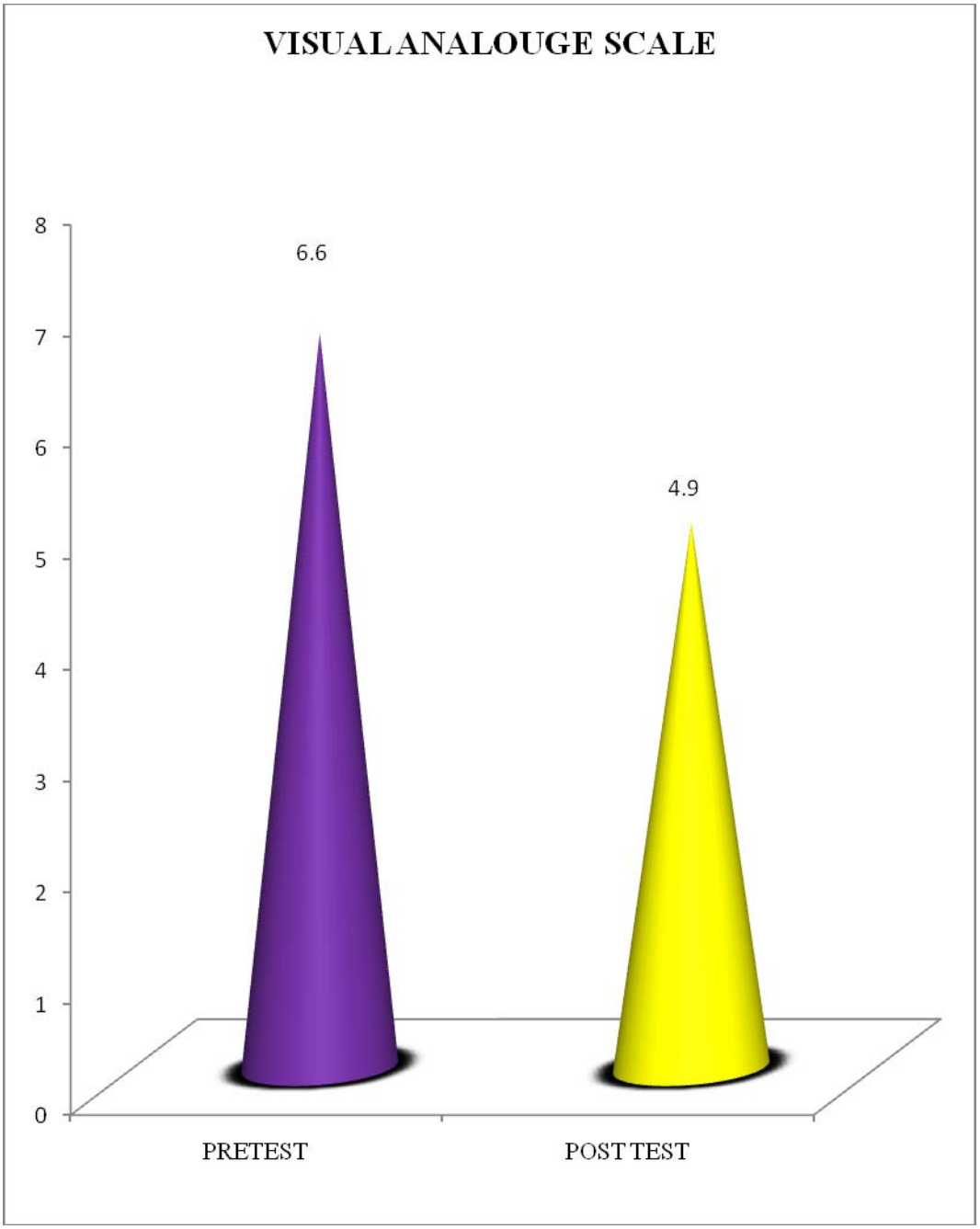


TABLE-XIV

PAIRED‘t’ TEST

MEAN, STANDARD DEVIATION, t-VALUE OF PRE- TEST AND POST-TEST VALUES OF SHOULDER PAIN AND DISABILITY SCORE (SPADI) IN GROUP A

S No	Shoulder pain and disability score	Mean	S.D	Mean difference	‘t’ value
1	Pre test	65.2	10.1	35.9	11.3
2	Post test	29.3	5.83		

For 9 degrees of freedom and at 5 % level of significance, the table value is 2.262. This is lesser than the calculated value is 11.3. So there is significant effect of scapular taping, glenohumeral mobilizations and exercises (Group A) in reducing shoulder pain and disability scores.

GRAPH-X

COMPARING THE PRE-TEST AND POST-TEST VALUES OF SHOULDER PAIN AND DISABILITY SCORE (SPADI) IN GROUP A [SCAPULAR TAPING, GLENOHUMERAL MOBILIZATION AND EXERCISES]

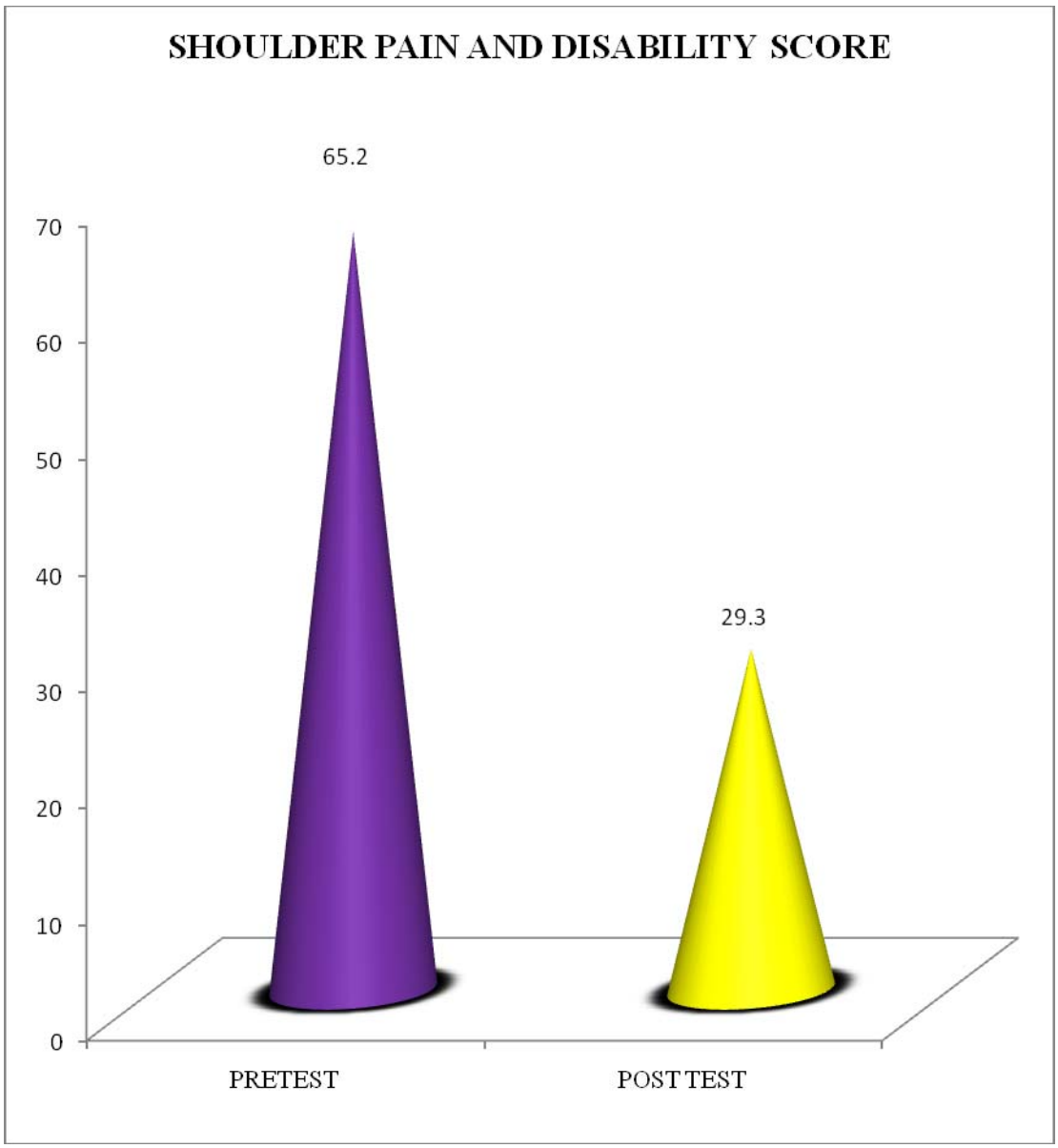


TABLE-XV

PAIRED‘t’ TEST

MEAN , STANDARD DEVIATION, t-VALUE OF PRE TEST AND POST TEST VALUES OF SHOULDER PAIN AND DISABILITY SCORE (SPADI) IN GROUP B

S No	Shoulder pain and disability score	Mean	S.D	Mean difference	‘t’ value
1	Pre test	65.7	9.53	22.1	7.7
2	Post test	43.6	10.9		

For 9 degrees of freedom and at 5 % level of significance, the table value is 2.262. This is lesser than the calculated value of 7.7. So there is significant effect of glenohumeral mobilizations and exercises (Group B) in reducing shoulder pain and disability scores.

GRAPH-XI

COMPARING THE PRE-TEST AND POST-TEST VALUES OF SHOULDER PAIN AND DISABILITY SCORE (SPADI) IN GROUP B [GLENOHUMERAL MOBILIZATION AND EXERCISES]

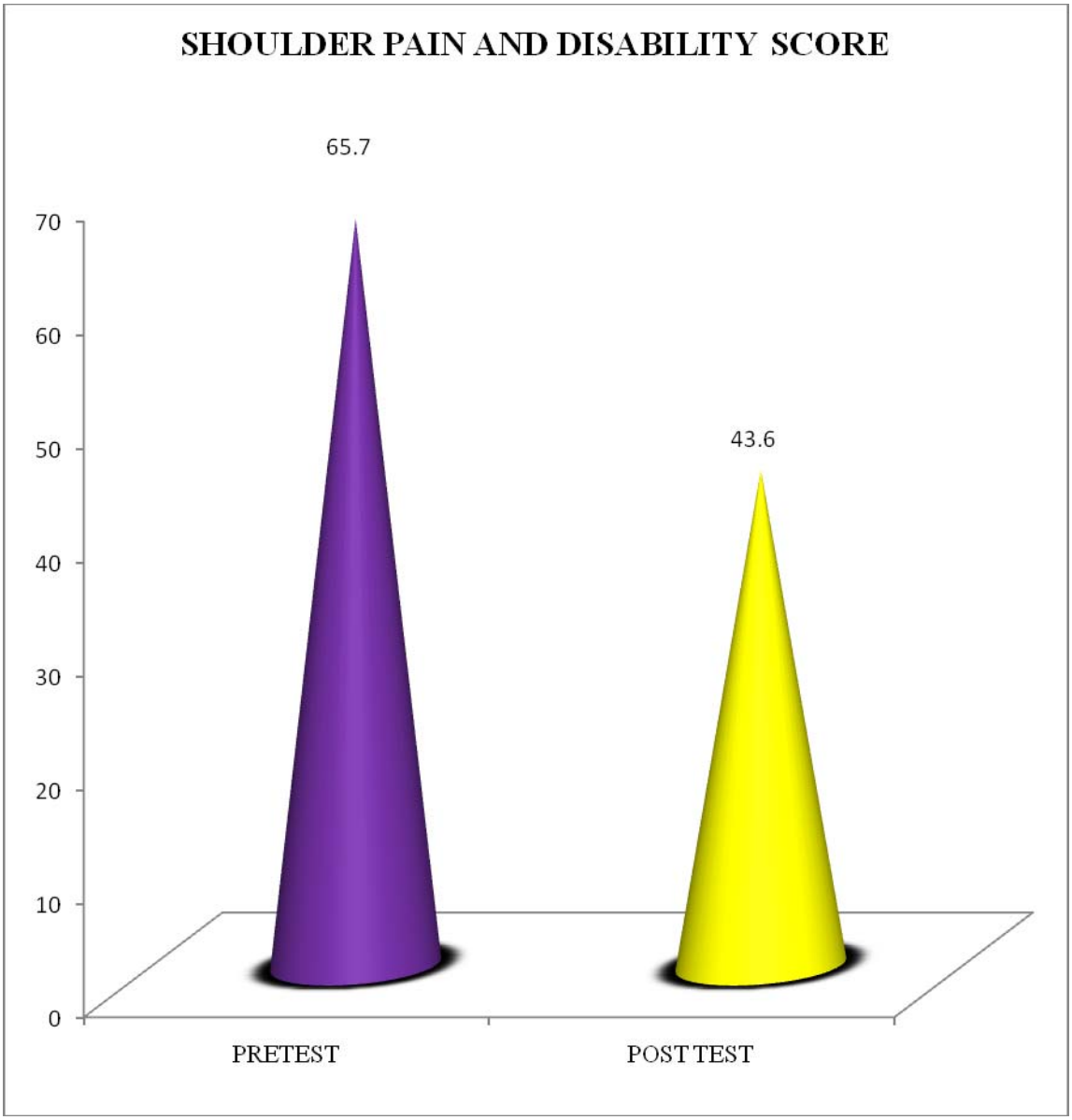


TABLE-XVI

PAIRED‘t’ TEST

MEAN, STANDARD DEVIATION, t-VALUE OF PRE TEST AND POST TEST VALUES OF SHOULDER PAIN AND DISABILITY SCORE IN GROUP C

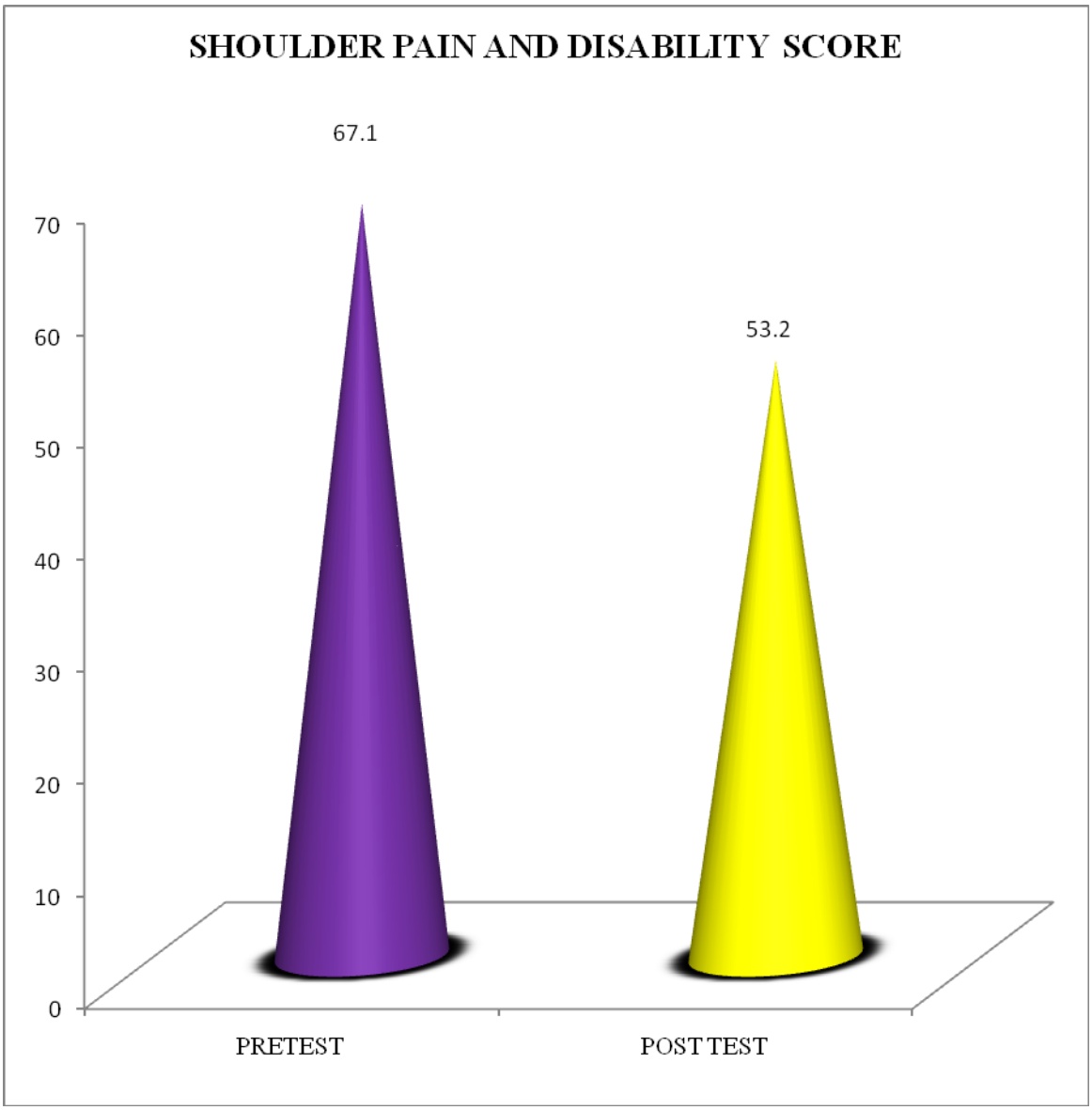
S No	Shoulder pain and disability score	Mean	S.D	Mean difference	‘t’ value
1	Pre test	67.1	7.46	13.9	5.85
2	Post test	53.2	5.85		

For 9 degrees of freedom and at 5 % level of significance, the table value is 2.262. This is lesser than the calculated value of 5.85. So there is significant effect of exercises alone (Group C) in reducing shoulder pain and disability scores.

GRAPH-XII

COMPARING THE PRE -TEST AND POST- TEST VALUES OF SHOULDER PAIN AND DISABILITY SCORES IN GROUP C

[EXERISES ONLY]



V DISCUSSION

This study was done to find out the effect of scapula taping, glenohumeral mobilization and exercises on pain and function in patients with sub-acromial impingement syndrome.

Potential factors causing or contributing to sub-acromial impingement syndrome such which includes strength, coordination and integrity of the rotator cuff and the shoulder girdle muscles , mechanical or anatomical changes, hypo mobility or in stability of the glenohumeral joint or the scapula and this suggest a multi-factorial aetiology of sub-acromial impingement syndrome. (Deutsch A et al, 1996).

30 subjects who with sub-acromial impingement syndrome fulfilled inclusive and exclusive criteria were selected and divided into 3 groups as 10 in each group. Group A underwent scapula taping, glenohumeral mobilization and exercises. Group B underwent glenohumeral mobilization and exercises, Group C underwent exercises alone. Outcome measures such as pain and function were measured by using visual analog scale and shoulder pain and disability scores (SPADI).

Statistical analysis was done by using One way analysis of variance (ANOVA), Un-paired‘t’ test and Paired ‘t’ test.

One way analysis of variance was done to find out any variance between the groups and within all the samples in all the three groups. One way analysis of variance for pre-test values of visual analogue scale and shoulder pain and disability scores showed that there was no significant difference between and within the three groups with respect to pain and function. One way analysis of variance for post-test values of visual analogue scale and shoulder pain and disability scores showed that there was significant difference between and within the three groups with respect to pain and function in patients with sub-acromial impingement syndrome.

Further in this study, paired‘t’ test was used to find out improvement within the groups and unpaired‘t’ test was used to compare the outcomes between the two groups.

In group A, paired ‘t’ test showed that there was significant effect of scapula taping, glenohumeral mobilization and exercises in reduction of pain and improvement of function. This result was consistent with previous studies as follows;

Immediate marginal increase of the lower trapezius muscle strength, which can be explained by the results of the facilitated muscle activity and the improved scapular alignment. This indicates benefits of taping to aid the scapular muscle

training in the patients with shoulder impingement syndrome (Yin-Hsin Hsu et al, 2008). Taping works by offering constant proprioceptive feedback or providing alignment correction during dynamic movements (Alexander et al,2003; Ackermann et al, 2002). Kinesio taping over the lower trapezius tended to increase scapular posterior tilt during humeral elevation in the subjects with shoulder impingement. It was observed that the decreased scapular posterior tilt in the subjects with shoulder impingement syndrome occurred around during humeral elevation. This suggested that kinesiotaping might assist in correcting the affected scapular movements, and thus help these subjects to have their arm function on a more balanced and stabilized base (the scapula) (Endo et al 2001).

In group B, paired‘t’ test showed that there was significant effect of glenohumeral mobilization and exercises in reduction of pain and improvement of function. This result was consistent with previous studies as follows;

Manual techniques such as mobilization and mulligan mobilization with movement activate the mechanoreceptors and inhibit the painful stimuli through gate control mechanism to reduce pain. It also helps to facilitate synovial fluid nutrition, stretch capsule and restore normal glenohumeral arthrokinematics (Melzak R 1965, Wall PD 1978, Threlkeld AJ 1992).

In group C, paired‘t’ test showed that there was significant effect of exercises alone in reduction of pain and improvement of function. This result was consistent with previous studies as follows.

Exercise group compared to placebo reported significant improvements in subjects with sub-acromial impingement at both 6 months and 2.5 years (Brox et al 1993, 1999). Exercises aimed at restoration of muscular deficits in strength, mobility &co-ordination of rotator cuff and shoulder girdle, unloading sub-acromial space and centring humeral head during the movements in glenoid fossa (Thilo O kromer et al, 2010).

When comparing the post-test values of group A and B by using unpaired‘t’ test. The results showed that there was significant difference between the effect of group A and B in reduction of pain and improvement of function. So scapula taping, glenohumeral mobilisation and exercises is better than glenohumeral mobilization and exercises in reduction of pain and improvement of function in patients with sub-acromial impingement syndrome.

Taping provides reduction of pain when assessed by self-reported measures of function and on active movements. Thus, the reduction in pain as a product of scapular taping may permit the more effective administration of manual techniques and exercises targeting the shoulder dysfunction. This benefit is not maintained on

follow-up but occurs only while the taping is continued (Peter Miller and Peter Osmotherly, 2009).

When comparing the post-test values of group B and C by using unpaired‘t’ test. The results showed that there was significant difference between the effect of group B and C in reduction of pain and improvement of function. So glenohumeral mobilization and exercises is better than exercises alone in reduction of pain and improvement of function in patients with sub-acromial impingement syndrome.

Combination of manual therapy and exercise is commonly used in the management of sub-acromial impingement syndrome. It aims to correct the modifiable physical impairments causing pain and dysfunction. Such impairments are tightness of the posterior capsule, postural abnormalities, rotator cuff and scapular muscle weakness and dysfunction and other soft tissues (Tuite MJ et al, 1995; Nicholson GP et al, 1996)

Manual physical therapy when combined with supervised shoulder exercise is superior to supervised shoulder exercise alone for enhancing strength and function and reducing pain in patients with shoulder impingement syndrome. (Michael D. Bang and Gail D. Deyle, 2000)

When comparing the post- test values of group A and C by using unpaired ‘t’ test. The results showed that there was significant difference between the effect of group A and C in reduction of pain and improvement of function. So scapula

taping, glenohumeral mobilisation and exercises is better than exercises alone in reduction of pain and improvement of function in patients with sub-acromial impingement syndrome. Scapular taping is an adjunctive treatment commonly used for shoulder impingement pathology *(*Peter miller et al, 2009).

Exercises emphasized on restoration of muscular deficits in strength, reduction of sub-acromial stress, restoration of glenohumeral capsular mobility, restoration of strength and timing of the rotator cuff and para scapular musculature, centring humeral head during the glenohumeral movements. Thereby reduction of pain and improvement of function resulted in patients with sub-acromial impingement syndrome.

Glenohumeral mobilizations activate mechanoreceptors and inhibit nociceptive stimuli through gate control mechanism to reduce pain. It also facilitates synovial fluid nutrition, stretch capsule and restores normal glenohumeral arthrokinematics thereby reduces pain and improve function.

In addition to effects of glenohumeral mobilization and exercises, Scapula taping reduces pain and may permit effective administration of manual therapy techniques and exercises targeting the shoulder dysfunction. It also facilitates the lower trapezius activity and improves scapular alignment. It provides constant proprioceptive feedback or correct alignment during dynamic movements.

This study showed that scapula taping, glenohumeral mobilization and exercises is effective in reduction of pain and improvement of function in patients with sub-acromial impingement syndrome.

VI SUMMARY & CONCLUSION

The aim of this study was to find out the effects of glenohumeral mobilization and exercises combined with scapular taping on pain and function in patients with sub-acromial impingement syndrome.

30 subjects were selected in the age group between 35-50 years after due considerations of inclusion & exclusion criteria. The subjects were allotted into three groups.

Group A received scapular taping, glenohumeral mobilization and exercises, Group B received glenohumeral mobilization and exercises and Group C received exercises only. The values of outcome were recorded before the beginning of treatment regime and at the end of treatment regime.

Statistical analysis was done using one way analysis of variance .ANOVA was done to find out any variance between group and within the samples in all three groups. Paired ‘ t’ test was used to find out the improvement within the group. Unpaired‘t’ test was used to find out the difference between the two groups.

The results showed that there was significant difference between scapular taping, glenohumeral mobilization and exercises group, glenohumeral mobilization

and exercise group and exercises only group in reducing pain and improving function in patients with sub-acromial impingement syndrome.

This study concluded that scapular taping, glenohumeral mobilization, exercises group was more effective than glenohumeral mobilization and exercises group and exercises only group in reducing pain and improving function in sub-acromial impingement syndrome.

VII LIMITATIONS AND RECOMMENDATIONS

- This study was a short term study, it is therefore necessary to do a long term study to make the results more valid.
- Sample studied was small so the study reduces the generalizing ability therefore study with a much larger population is recommended.
- Studies aimed to find out the effectiveness of other mobilization techniques like Mulligan's movement with mobilizations, specific exercises for the stabilization of scapula can be conducted in future.
- This study considered the short term effects of scapular taping, long term effects of which can be studied further.

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IX APPENDIX

APPENDIX-I

SHOULDER PAIN AND DISABILITY INDEX

Please place a mark on the line that best represents your experience during the last week attributable to your shoulder problem.

Pain scale

How severe is your pain?

Circle the number that best describes your pain where: **0** = no pain and **10** = the worst pain imaginable.

At its worst?	0	1	2	3	4	5	6	7	8	9	10
When lying on the involved side?	0	1	2	3	4	5	6	7	8	9	10
Reaching for something on a high shelf?	0	1	2	3	4	5	6	7	8	9	10
Touching the back of your neck?	0	1	2	3	4	5	6	7	8	9	10
Pushing with the involved arm?	0	1	2	3	4	5	6	7	8	9	10

Total pain score /50 x 100 = %

(Note: If a person does not answer all questions divide by the total possible score, eg. if 1 question missed divide by 40)

Disability scale

How much difficulty do you have?

Washing your hair?	0	1	2	3	4	5	6	7	8	9	10
Washing your back?	0	1	2	3	4	5	6	7	8	9	10
Putting on an undershirt or jumper?	0	1	2	3	4	5	6	7	8	9	10
Putting on a shirt that buttons down the front?	0	1	2	3	4	5	6	7	8	9	10
Putting on your pants?	0	1	2	3	4	5	6	7	8	9	10
Placing an object on a high shelf?	0	1	2	3	4	5	6	7	8	9	10
Carrying a heavy object of 10 pounds (4.5 kilograms)	0	1	2	3	4	5	6	7	8	9	10
Removing something from your back pocket?	0	1	2	3	4	5	6	7	8	9	10

Circle the number that best describes your experience where: 0 = no difficulty and 10 = so difficult it requires help

Total disability score: _____/ 80 x 100 = %

(Note: If a person does not answer all questions divide by the total possible score, e.g. if 1 question missed divide by 70)

Total SPADI score: _____ 130 x 100 = %(Note: If a person does not answer all questions divide by the total possible score, e.g. if 1 question missed divide by 120)

Minimum Detectable Change (90% confidence) = 13 points

(Change less than this may be attributable to measurement error)

APPENDIX II

EXERCISES

Name	Description	Dosage	Weeks performed
Scapular setting	Sitting, isometric hold of scapula in retracted and depressed position	5 sec hold x 5 repetitions	week 1 then maintained in all exercises
Resisted scapular setting- elbow extension with shoulder neutral	Standing, arm by side and elbow bent holding theraband attached in front at shoulder height. Elbows straightened arms slowly flexed whilst keeping scapula in set position	10 repetitions x 2 using theraband	Weeks 3 – 6

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Resisted scapular setting – elbow flexion	Standing with hands at chest height, elbow bent and holding on the theraband which is then stretched apart by straightening both elbows.	10 repetitions x 2 using theraband	Weeks 4 – 6
Posterior shoulder stretch	Standing, pulling the elbow passively across the body into the horizontal adduction with opposite arm	5 reps with 10 sec hold x 2	Week 1 and 2
Pectoralis minor stretch	Supine with arm in 45^0abduction and elbow to 90^0.Shoulder rotate into external rotation.	5 reps with 10 sec hold x 2	Weeks 2 – 6

Corner stretch	Standing with one hand on each corner wall at shoulder height and elbow bent. Leaning in toward corner to stretch anterior shoulder and thoracic spine	5 reps x 10 sec hold	Weeks 5- 6
Self resisted isometric external rotation	Standing sideways to wall. Upper arm squeezing a towel roll against body ,elbow bend with forearm pushing into wall	5 sec hold x 10 reps	Weeks 1- 2
Active external rotation	Sitting with shoulder in 45^0 abduction resting elbow and forearm on table in internal rotation. Taking shoulder into external rotation.	10 reps x 2	Weeks 1 – 2

Resisted external rotation	Standing, elbow bent to 90^0andforearm onto thera band at waist height .keeping elbow into side, pulling against theraband to perform external rotation.	10 reps x 2 using theraband	Weeks 3 and 4
Resisted internal rotation	Standing, elbow bent to90^0 and shoulder in external rotation and holding onto theraband at waist height. Keeping elbow in by side, pulling against theraband to perform internal rotation.	10 reps x 2 using theraband	Weeks 3and 4

Resisted external rotation in supported 90^0abduction	Sitting with shoulder supported in 90^0abduction on table and forearm resting on table holding a weight in hand. Weight lifted towards ceiling keeping elbow on table	10reps x 2 using hand weight	Weeks 5 and 6
Resisted internal rotation in supported 90^0abduction	Sitting with shoulder supported in 90^0 abduction on table and forearm resting on table holding theraband attached behind hand taken to table to perform internal rotation.	10 reps x 2 using theraband	Weeks 5 and 6

Resisted external rotation in unsupported abduction	External rotation performed in standing with shoulder unsupported in 45^0 scapular plane ,elbow bent & holding theraband attached in front	10 reps X 2	Weeks 6
Resisted internal rotation in unsupported abduction	Internal rotation performed in standing with shoulder un supported in 45^0 scapular plane, elbow bent & holding thera band attached behind.	10 reps x 2	Week 6

APPENDIX-III

ORTHOPAEDIC ASSESSMENT

SUBJECTIVE EXAMINATION

Name : Date of assessment:

Age :

Sex :

Occupation:

Address :

Chief complaints:

History:

Present medical history:

Past medical history:

Drug history:

Surgical history:

Personal history:

Family history:

Socioeconomic history:

Psychological history:

Environmental history:

Associated problems:

Pain history:

Site:

Side:

Onset:

Duration:

Type:

Nature:

Frequency:

Aggravating Factors:

Relieving Factors:

Intensity: visual analogue scale (VAS)

Vital signs

Temperature: Blood Pressure:

Heart Rate: Respiratory Rate:

OBJECTIVE EXAMINATION

ON OBSERVATION:

Built:

Posture:

Attitude of Limbs:

Tropical Changes:

Swelling:

Bony contours:

Deformities:

ON PALPATION:

Tenderness:

Warmth:

Edema:

Pulse:

ON EXAMINATION:

Range of Motion:

REGION	**ACTIVE**		**PASSIVE**	
	RIGHT	**LEFT**	**RIGHT**	**LEFT**

End Feel:

Muscle Power:

Muscle tone:

Limb Girth Measurement:

Functional assessment: Shoulder pain and disability index

SPECIAL TEST:

Neer’s impingement and Hawkins’s- Kennedy impingement test.

INVESTIGATION:

DIAGNOSIS:

PROBLEM LIST:

AIMS:

MEANS:

HOME PROGRAM:

APPENDIX-IV

CONSENT FORM

This is to certify that I _____ freely and voluntarily agree to participate in the study "**EFFECT OF GLENOHUMERAL MOBILIZATION AND EXERCISES COMBINED WITH SCAPULAR TAPING ON PAIN AND FUNCTION IN PATIENTS WITH SUB-ACROMIAL IMPINGEMENT SYNDROME".**

I have been explained about the procedures and the risks that would occur during the study.

Participant:

Witness:

Date:

I have explained and defined the procedure to which the subject has consented to participate.

Researcher:

Date: